

## What is Claimed Is:

- 1           1.     An microfluidic device comprising:
  - 2           A) a substrate with a top surface comprising a channel, wherein the
  - 3           channel has a width, a bottom and a sidewall; and
  - 4           B) a cover positioned over the substrate in alignment with the
  - 5           substrate,
  - 6           wherein the channel is accessed through an access port to the channel, the
  - 7           access port positioned on at least one of the cover and the bottom.
- 1           2.     The microfluidic device of claim 1 wherein the access port to the
- 2           channel is an opening on the channel bottom.
- 1           3.     The microfluidic device of claim 1 wherein the access port to the
- 2           channel is an opening on the cover.
- 1           4.     The microfluidic device of claim 1 wherein the channel bottom is
- 2           coplanar with the top surface of the substrate, and the channel sidewall rises
- 3           from the substrate surface at an angle between about 45 and 135 degrees,
- 4           wherein the substrate, and the sidewall are composed of a polymeric
- 5           material.
- 1           5.     The microfluidic device of claim 4 wherein the channel sidewall
- 2           comprises a thin region of the sidewall.
- 1           6.     The microfluidic device of claim 5 wherein the sidewall
- 2           comprises a plurality of thinned regions.

1           7.     The microfluidic device of claim 5 wherein a metal is deposited  
2 on the thinned region.

1           8.     The microfluidic device of claim 1 wherein the channel bottom  
2 is beneath a plane co-planar with the top surface of the substrate.

1           9.     The microfluidic device of claim 1 wherein the device further  
2 comprising an alignment device adapted to align the cover with the substrate.

1           10.    The microfluidic device of claim 9 wherein the alignment  
2 device is a dowel pin positioned on the substrate.

1           11.    The microfluidic device of claim 9 wherein the alignment  
2 device is a protrusion positioned on the cover.

1           12.    The microfluidic device of claim 9 wherein the alignment  
2 device is accurate to better than 0.001 inch.

1           13.    The microfluidic device of claim 1, the device further  
2 comprising a capillary positioned in the channel access port and inserted in  
3 the channel, wherein the access port has a diameter and the capillary has an  
4 outer diameter, and wherein the capillary outer diameter and the access port  
5 diameter are approximately equal.

1           14.    The microfluidic device of claim 13 wherein an adhesive  
2 secures the outer circumference of the capillary to the access port.

1           15.    The microfluidic device of claim 13 wherein the capillary is  
2 made of a second polymeric material that is transparent.

1           16.    The microfluidic device of claim 1, the device further  
2   comprising a capillary positioned in the channel access port and inserted in  
3   the channel, wherein the capillary has an inner cross-sectional area and the  
4   channel has a cross-sectional area and the capillary cross-sectional area and  
5   the channel cross-sectional area are approximately equal.

1           17.    The microfluidic device of claim 1 wherein the device  
2   comprises a first and a second channel, the second channel positioned below  
3   the first channel, the first channel has a conduit extending from the bottom of  
4   the first channel to the second channel.

1           18.    The microfluidic device of claim 1 wherein the device further  
2   comprises a structure selected from the group consisting of a reservoir  
3   structure, a detector window region, a microreactor and a distillation column,  
4   wherein a capillary connects the channel to the structure.

1           19.    The microfluidic device of claim 1 wherein the substrate  
2   comprises a plurality of conical nozzles, the conical nozzles positioned in a  
3   geometrical array.

1           20.    The microfluidic device of claim 1 wherein the cover further  
2   comprises an interconnecting duct, the duct connects to at least one channel  
3   via the access port.

1           21.    The microfluidic device of claim 1 wherein the sidewall  
2   comprises an inner surface facing the channel and an outer surface opposite  
3   the inner surface; and wherein the cover comprises a bottom surface, the

4 bottom surface facing the top surface of the substrate; the cover further  
5 comprising a protrusion that extends from the bottom surface of the cover;  
6 wherein the cover protrusion is adjacent to the inner surface of the sidewall.

1 22. The microfluidic device of claim 1 wherein the sidewall  
2 comprises an inner surface facing the channel and an outer surface opposite  
3 the inner surface; and wherein the cover comprises a bottom surface, the  
4 bottom surface facing the top surface of the substrate; the cover further  
5 comprising a protrusion that extends from the bottom surface of the cover;  
6 wherein the cover protrusion is adjacent to the outer surface of the sidewall.

1 23. The microfluidic device of claim 22 wherein an interstitial  
2 region is formed between the top surface of the substrate and the bottom  
3 surface of the cover in regions bordering the outer surface of the sidewall.

4 24. The microfluidic device of claim 1 wherein the channel  
5 comprises a channel structure positioned within the channel and oriented  
6 perpendicular to the channel sidewall, and perpendicular to the channel  
7 bottom.

1 25. The microfluidic device of claim 1 wherein the channel  
2 comprises a first linear section and a second linear section, wherein the first  
3 and second linear sections are perpendicular.

1 26. The microfluidic device of claim 1 wherein the channel bottom  
2 has a width of greater than 100 $\mu$ m.

1           27.    The microfluidic device of claim 1 wherein the channel  
2   sidewall is between 10  $\mu\text{m}$  and 50  $\mu\text{m}$  in height.

1           28.    The microfluidic device of claim 1 wherein the sidewall and  
2   channel bottom are formed from the polymeric material.

1           29.    The microfluidic device of claim 1 wherein the polymeric  
2   material is a low melt viscosity polymer.

1           30.    The microfluidic device of claim 29 wherein the polymeric  
2   material is selected from the group consisting of polycyclic olefin polyalkane  
3   co-polymers, poly methyl methacrylate, polycarbonate, polyalkanes,  
4   polystyrenes and polymer blends containing a liquid crystalline polymer as an  
5   additive.

1           31.    The microfluidic device of claim 1 wherein the device  
2   comprises an additional substrate, the additional substrate comprising a  
3   channel architecture, wherein the substrates are bonded together, and further  
4   wherein the device comprises a conduit connecting the channel and the  
5   channel architecture.

1           32.    A process of making a microfluidic device, the device  
2   comprising a substrate and a channel architecture, the method comprising:

3           A.    preparing an injection molding mold, wherein preparing the  
4   injection molding mold comprises forming a negative impression of the  
5   channel architecture;

6 B. injecting a polymeric material into the injection molding mold  
7 or mold insert, and

8 C curing the polymeric material.

1 33. The process of claim 32 wherein the injection molding mold is  
2 prepared from a material selected from the group consisting of metal, silicon,  
3 ceramic, glass, quartz, sapphire and polymeric material.

1 34. The process of claim 32 wherein preparing the injection  
2 molding mold comprises forming the negative impression of the channel  
3 architecture by a technique selected from the group consisting of  
4 photolithographic etching, stereolithographic etching, chemical etching,  
5 reactive ion etching, laser machining, rapid prototyping, ink-jet printing and  
6 electroformation;

1 35. The process of claim 32 wherein preparing the injection  
2 molding mold comprises forming the negative impression of the channel  
3 architecture by electroforming metal, and wherein the process further  
4 comprises polishing said mold.

1 36. A microfluidic device comprising a substrate with a top surface  
2 comprising a channel, wherein the channel comprises a bottom and a  
3 sidewall, said substrate formed by a process comprising:

4 preparing an injection molding mold, wherein preparing the injection  
5 molding mold comprises forming a negative impression of the channel;  
6 injecting a polymeric material into the injection-molding mold;

- 7 curing the polymeric material to form the substrate; and  
8 removing the substrate from the injection-molding mold.
- 1 37. A microfluidic device comprising:  
2 A) a substrate with a top surface comprising a plurality of non-intersecting  
3 channels, wherein each channel has a width, a bottom, and a sidewall; and  
4 B) a cover positioned over the substrate in alignment with the substrate,  
5 wherein each of the channels are accessed through an access port to the  
6 channel, the access port positioned on at least one of the cover and the bottom.  
7

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